

A STUDY ON PROFITABILITY OF GROWING COTTON IN KURNOOL DISTRICT OF ANDHRA PRADESH

K. VISWESWARA REDDY¹ & E. LOKANADHA REDDY²

Department of Economics, Sri Venkateswara College of Engineering. & Tech., Andhra Pradesh. India

ABSTRACT

Agriculture forms the back bone of the Indian Economy. Being the largest industry in the country, agriculture provides employment to around 65 percent of the total work force. The share of agriculture in the national income is 19 percent. It is the source of supply of raw material to our leading industries. Commercial crops have contributed very significantly to the growth of Indian economy. Cotton is most important commercial crop in India. Cotton is also the most vital crop of commerce, popularly known as the 'White Gold'. Different cotton varieties are grown under both rain fed and irrigated conditions in India. There are 9 chief cotton producing states. The main objective of this study is how best individual input factors are being utilized by cotton cultivators to raise the cotton yield in Kurnool District. The efficiency of input factors are analysed by costs and return structure, input and output structure, analyzing the factor-product relations through multiple regression analysis and calculating marginal values of the product. The conclusions were drawn from the analysis.

KEYWORDS: Agriculture, Commercial Crops, Cotton Production, Profitability, Multiple Regression and Marginal Value Product

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INTRODUCTION

Agriculture forms the back bone of the Indian Economy and despite concerted industrialization in the last five decades, agriculture occupies a place of pride. Being the largest industry in the country, agriculture provides employment to around 65 percent of the total work force in the country. The share of agriculture in the national income is 19 percent.

The share of agriculture in Gross Domestic Product (GDP) in 1951 was 55 percent, by 2000 it had fallen to 25 percent and now it is 21 percent. Looking forward, we can expect it to fall further. Two important facts must be emphasized here: a) Agriculture contributes even now a major share of the national income in India. b) The share of agriculture in nation's income, however, has been decreasing continuously and the shares of the manufacturing and services sectors are increasing.

Agriculture dominates the economy to such an extent that a very high proportion of working population in India is engaged in agriculture. Data provided by the census of India reveals that in absolute terms, agriculture provided employment to 97 million persons in 1951, the number of people working on land increased to 235 million in 2001.

Indian agriculture has been the source of supply of raw material to our leading industries. Cotton and jute industries, sugar, vanaspathi and plantations – all these industries depend on agriculture directly. There are many

other industries which depend on agriculture in an indirect manner. Many of our small scale and cottage industries like handloom weaving, oil crushing, rice husking, etc., depend upon agriculture for their raw material – together they account for 50 percent of income generated in the manufacturing sector in India.

Commercial crops have contributed very significantly to the growth of Indian economy. Commercial crops are intensive and the total employment generated by the four major commercial crops Sugarcane, Groundnut, cotton and potato is estimated at 3,392.2 Million Man-days in 1982-83. India is a traditional exporter of oil seed cakes and meals. Jute is one of the most important agricultural exports and it was the largest exchange earner in early seventies. To-day India is not only surplus in raw cotton but also produces one of the finest varieties like Suvin. India is the world's largest producer of Sugarcane. Thus commercial crops contribute significantly to the export sector. But the productivity of commercial crops is much lower than that in many other countries. All over the world, high yields of Sugarcane, cotton, oil seeds, Tobacco and jute have been obtained where they are grown with adequate inputs and under efficient farm management.

Among commercial crops, Sugarcane and Cotton enjoyed privileged positions in terms of allocation of research resources. The development of high yielding hybrid cotton varieties and their rapid spread in the major cotton producing states helped cotton cultivation to turn the corner in the seventies.

Cotton is most important commercial crop in India. Cotton a crop of prosperity, having a profound influence on men and matter, is an industrial commodity of worldwide importance. Cotton crop occupies an area of 5.4 million hectares under rainfed conditions. About 60% of the cotton is grown on vertisols in Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamilnadu. It generates employment for about 60 million people either directly or indirectly, by involving them in the agricultural and industrial sectors of cotton production, processing, textiles and related activities.

The domestication of the cotton plant for commercial cultivation for clothing as well as for other forms of human utilization is considered to have begun from Harappa civilization. Indian economy has been consistently influenced and boosted by cotton through its production and processing sectors. Cotton is the most vital crop of commerce, popularly known as the '**White Gold**'.

Economic growth in India is directly a function of agriculture. It is the single largest determinant of nation's income. The success of economic development of a country will depend upon the order of development achieved in agriculture. A rapid expansion of agriculture is required to feed large population in the country. The present production of agriculture is just about to meet the minimum requirements.

The economy of Andhra Pradesh is predominantly agriculture and majority of its population is dependent on this sector. This state is popularly known as 'Granary of the South'. The food crops production particularly paddy ranks sixth in area, fourth in production. The cash crops production particularly cotton ranks sixth place in production, fifth place in area and sixth in yield.

Cotton is one of the important commercial crops produced in India. The area under cotton in India is the largest in the world. India's cotton production ranks fourth in the world but its yields are the lowest. Approximately, India achieved its self sufficiency in cotton production.

Different cotton varieties are grown under both rain fed and irrigated conditions in India. There are 9 chief cotton producing states. Of these, four states viz. Andhra Pradesh, Karnataka, Rajasthan and Tamil Nadu have rapid growth rates in yields of which 3 belong to Southern India.

These nine states together account for more than 90 percent of the total area and production under cotton on an average. The proportion of irrigated area to the total area under cotton in India has been increasing over the years, particularly in the case of the 9 major cotton producing states.

Among south Indian states, Andhra Pradesh stands second geographically. Andhra Pradesh state is divided into three regions viz. Coastal Andhra, Rayalaseema and Telangana. Rayalaseema region covered with four districts. Among these four districts, Kurnool stands first place in cotton area and production. Kurnool district was purposefully selected for our research study.

The main aim of the chapter is how best individual input factors are being utilized by cotton cultivators to raise the cotton yield in Kurnool District. The efficiency of input factors are analysed by costs and return structure, input and output structure, analyzing the factor-product relations through multiple regression analysis and calculating marginal values of the product.

REVIEW OF LITERATURE

S.E Dhote, A.K.Srivasthava¹ attempted in their study to examine and compare the economies of high yielding variety of cotton and traditional cotton yield. It covers the factors of cost by size of farmers; determine the comparative importance of the resource inputs and their productivity and to estimate the production function. The cotton crop, with a view to finding out comparative economies of two classes of cotton variety, a sample survey was undertaken in 1973 – 74. To estimate the economies of two classes of cotton variety, the total cost of cultivation was split according to some cost concept. The significance of difference in cost of cultivation net income and output input ratio among variety and size groups was tested by analysis of variance ('F' test). It is observed that the cost for both per hectare and per quintal is much higher for HYV cotton than for the traditional cotton. The major items of expenditure of HYV cotton variety were manures and fertilizers, human labour and insecticides. For traditional cotton, the main items of expenditure on input factors were human labour, bullock labour, insecticides and manures. HYV cotton gave higher net income, family labour income and farm business income than traditional cotton variety. To negative regression coefficient, the marginal productivities of manures and fertilizers for HYV cotton and human labour for traditional cotton are negative. The positive M.V.P of plant protection measure, fertilizers in case of traditional variety was observed. They concluded that the high input cost of HYV and involving heavier cost outlays are compensated by higher returns high enough to cover the risks involved. H.Y.V of cotton also offered more employment for human labour compared to traditional cotton varieties.

Daram Narain's² study is devoted to graphical comparison of year to year variations in acreage of six crops Cotton, Jute, Ground Nut, Sugarcane, Rice and Wheat. He concluded that the Indian farmers are significantly responsive to price. He has proved that in some specific regions, at least price exerts a significant influence on the variations of food grains area.

S. S. Grewal and P.S.Rangi³ in their attempt, calculated compound growth rates of area, yield and production of important crops in Punjab State during the year 1966 – 67. to 1981 – 82. Cotton is one among the crops taken into consideration. American cotton was also recorded significant growth rate, in this entire increase in production has occurred as a result of increase in area. Desi cotton had shown negative growth rates of production in the study period. In case of American cotton, production has shown significant increase. Regarding the American cotton and Desi cotton there is absolutely decrease in productivity since the trend is on decline. They critically examine the growth pattern of agriculture

in Punjab, particularly focusing on the factors associated with the growth process.

Konda Swamy⁴ attempted to study the commercial crops in respect of labour intensive and total employed generated by the four major commercial crops: Sugar Cane, Ground Nut, Cotton and Potato. Among commercial crops Sugar Cane and Cotton enjoyed privileged position in terms of allocation of resources. The development of HYV Hybrid cotton varieties and their rapid spread in the major cotton productive states helped cotton cultivation to turn the corner in the seventies(70's). the cotton varieties H4,H6,MCU – 5, DCH – 32, Varalakshmi Deserve specific mention, while fertilizers use is now nearly universal and spread to all crops the extent to diffusion and the rates of application of fertilizers are far less in crops like oilseeds, cotton and tobacco and also less than the potential indicated by experiments. Hence, we have to make a break- through in technology and organization fronts to make the cotton crop sector an efficient one.

To review the work on the response of agricultural production to changes in prices in the contest of Indian agriculture most of the investigators have used the model of Marc Nerlove⁵, who has attempted to estimate the elasticity of supply. His work has to deal primarily with the role of farmers' expectations of future prices in shaping their decisions as to how many acres they should devote to each crop.

Nagaraja and Bathaiah⁶ studied agricultural growth in Andhra Pradesh. They considered 15 major crops. They estimated compound growth rate for area, production and yield. They identified that the compound growth rate of cotton crop of area production and yield is 2.5, 14.7 and 11.0 these growth rates were significant at 5 percent level of probability. The highest growth rate of cotton production of 14.7 percent was recorded among all the crops under study. It observed that a marked acceleration in growth rate of cotton crop. It is due to yield increasing modern agricultural production technology. Finally the study reveals that both area and yield of cotton played a significant role in boosting of the agricultural production in Andhra Pradesh.

A. Nageswar Rao⁷ and others study information on cost and returns of cotton from the few selected farmers were obtained for sufficiently long period from 1969 -70 to 1985 – 86, in selected villages of Guntur district of Andhra Pradesh. Seed cost of cotton showed considerable increase in the early study period i.e., the early 70's. Because of pesticides cost were maximum both at the end of early 70's and early 80's higher initial profits from cotton in the early 70's, attracted the farmers to apply higher dose of fertilizers and use of pesticides indiscriminately and this resulted in losses from cotton.

Pritam Singh⁸ attempted to examine the economic efficiency on different size groups of farms with respect to bullock and tractor operated on cotton farms during the period 1973 – 74. Cotton yield was high in all tractor operated farms than those in their counterparts in bullock operated farms. Area under cotton as a percentage of cultivated area, increased with an increase in farm size on non tractorised farmers. But it was not shown in case of tractorised farmers. In case of tractorised farmers significant difference in return over cash operating expenses per hectare in respect of farm business as a whole were observed between large and small farmers. But in case of non tractorised farms this difference came out to be non significant among various farm size groups. It may be safely concluded from this study that there was direct relationship between farm size and economic efficiency on tractorised farms only. More over, the level of economic efficiency was observed to be higher on tractor operated farms as compared to that of bullock operated farms especially on medium and large farmers.

Rajvir Singh and Patel⁹ attempted to study the relative importance of purchased and owned inputs for wheat and sugar cane crops in agriculture and non agriculture sectors. They expressed, the larger farmers have a greater share in use of purchased inputs of agricultural origin. A higher rate of marginal value of productivity to be factor cost was observed for human labour on the small farmers and irrigation on the medium and large farmers in sugar cane and for human labour and medium farms and manure and fertilizer in wheat crops indicating the scope of increase to use these inputs on these crops in respective categories of farms.

Satyanarayana Reddy¹⁰ studied the problem of supply response in terms of changes in acreage under sugarcane. An important feature of this study is that besides the usual variables of relative price, he takes into account the installed capacity of the sugar factories and gur prices. The study suggests that the installed capacity of the factories have significant influence on the acreage of sugarcane. The influence of other variables differed from state to state.

OBJECTIVES OF THE STUDY

The following are the objectives of the current study:

- To analyse the profitability of growing cotton in Kurnool District.
- To identify the right kind of production technology and analyse the efficiency of resource allocation.

METHODOLOGY

The following methodology is adopted to study the above objectives. Primary data was collected from cotton growers in Kurnool district. Four major cotton varieties are grown in the district out of these two popular varieties of cotton were selected for the present study

One variety was selected from Non-Bt varieties, it is NHH-44. One variety was selected from Bt varieties it is Bunny. 25 growers from each cotton variety were selected by adopting multistage sampling. The relevant data was collected by interviewing the growers directly. The reference year is 2006-07. The data pertaining to cost and returns has been analyzed, using the tabular technique.

To analyse the effects of various input factors on cotton production with respective selected varieties, a multiple regression equation (Cobb-Douglas form) was adopted.

The proposed production function is

$$Y = a_0 \cdot X_1^{a_1} \cdot X_2^{a_2} \cdot X_3^{a_3} \cdot X_4^{a_4} \cdot X_5^{a_5} \quad (1)$$

Where, Y= Cotton yield per acre (In Rs)

X_1 = Land Rent (Rs/acre)

X_2 = Cost of Lab our (Rs/acre)

X_3 = Cost of Manure (Rs/acre)

X_4 = Fertilizers and Pesticides (Rs/acre)

X_5 = Miscellaneous Expenditure (Rs/acre)

a_0 = Intercept

a_i = Regression coefficients representing the elasticities of production with respect to the variables.

The Cobb Douglas function was shown mainly because of the ease of handling Logarithmic transformations and least squares technique was used to eliminate the production elasticities.

The marginal productivity of inputs is estimated by the following formula

$$MVP(X_i) = a_i \left[\frac{G.M(Y)}{G.M(X_i)} \right] \quad (2)$$

Where, G.M(Y) and G.M (X_i) represent the Geometric mean of output and inputs respectively, a_i is the regression coefficient of ith input.

FINDINGS

The main aim of the chapter is how best individual input factors are being utilized by cotton cultivators to raise the cotton yield in Kurnool District. The efficiency of input factors are analysed by costs and return structure, input and output structure, analyzing the factor-product relations through multiple regression analysis and calculating marginal values of the product.

Cost and Return Structure:

The cost and return structure of the two selected cotton varieties, Bt and non Bt varieties, in Kurnool district of A.P is given in the following table. Here two concepts are analyzed; the benefit cost analysis and input and output structure. A comparative picture of economies of production of selected varieties of cotton in Kurnool district was observed in the table.

Table 1: Cost and Returns Structure of Cotton Varieties in Kurnool District

Varieties	Gross Returns In Rs.	Gross Cost Rs./Acre	Net Returns In Rs.	Benefit Cost Ratio
Bt	25192	17428	7764	1.445
Non Bt	23152	18358	4794	1.261

The total cost of cultivation with individual cost like labour, Manure, Fertilizers and Pesticides, miscellaneous expenses like irrigation charges, transport cost, plant protection, depreciation, seed cost had been calculated by appropriate methods. Owing to gross returns, in terms of rupees, Bt cotton variety is more (Rs. 25,192) than the non Bt variety (Rs. 23,152). Observing the gross returns Bt variety has recorded highest gross returns.

The gross cost per acre in case of Bt variety is Rs. 17,428 where as in case of non Bt variety it is Rs. 18,358. Comparing the gross cost of two cotton varieties, it is observed that non Bt variety cotton growing cost is more than the Bt cotton variety.

Gross returns less gross cost gives net returns. From the table it is observed that the net returns of Bt cotton variety was recorded highest than the non Bt cotton variety in Kurnool district. The net returns of Bt variety is Rs. 7,764 where as net returns of non Bt cotton variety is Rs. 4,794. Between the two cotton varieties selected under this study, it is suggested that Bt cotton variety is most profitable and suitable variety to its growers in Kurnool district. It may be inferred

that the cotton growers may be benefited by allocating more area to Bt cotton variety in Kurnool district. Regarding the benefit cost ratio it is more (1.445), in case of Bt variety. Where as the benefit cost ratio of non Bt variety is less (1.261).

From the above cost and return structure of the selected cotton varieties in Kurnool district, Bt cotton variety can be grown in Kurnool district. The farm business analysis expresses that the Bt variety has the highest profitability from the growers' point of view.

Input and Output Structure

The input and output structure of two selected varieties of cotton at mean level in Kurnool district is given in the following table.

Table 2: Input and Output Structure at Mean Level

Variables	Bt variety	Non Bt variety	t – value
Yield	25192 (3391.741)	23152 (2104.676)	2.51*
Land Rent	5412 (513.859)	4880 (727.733)	2.93*
Labour	3148 (181.371)	3246 (220.414)	1.6819
Manure	741 (63.419)	795 (78.947)	0.8253
Fertilizers & Pesticides	4643 (441.557)	6219 (296.419)	14.518*
Miscellaneous Expenses	3484 (200.358)	3218 (161.786)	5.060*
Net Returns	7764	4794	

* Significant at 5% level of probability.

From the above table it is noticed that the average cotton yield was Rs. 25,192 and Rs. 23,152 for the two selected cotton varieties, Bt and non Bt in Kurnool district. The average yield per acre is more in case of Bt variety than the non Bt variety. It is observed that the difference in main yields of two cotton varieties is significant. This significance difference between cotton yields suggests that Bt cotton variety is more profitable than the other variety.

While considering the average cost of inputs of two varieties, it is observed that the average land rent is higher (Rs.5412) in case of Bt cotton varieties than the non Bt variety (Rs. 4880). The t – test statistic reveals that the mean difference in land rent is significant. The average labour cost is less (Rs.3,148) in case Bt variety. But it is (Rs.3.246) in case of non Bt variety. The difference between two cotton varieties in case of labour is statistically insignificant. Regarding the manure utilization, the non Bt cotton variety occupies first place (Rs.795). The Bt variety manure cost per acre is Rs. 741. From the t – Test statistic it is found that the difference between the mean values of manure is insignificant. In case of fertilizers and pesticides consumption, the average cost per acre is more (Rs. 6219) In case of non Bt variety than the Bt variety (Rs. 4643). The difference between mean expenditure on fertilizers and pesticides of two varieties is statistically significant. In case of miscellaneous expenses, Bt cotton variety stands first (Rs.3484) than the non Bt variety (Rs. 3280). It is noticed that the difference between the mean values of miscellaneous expenses of two varieties is significant at 5 percent probability level.

It is concluded that there exists a remarkable difference between the two cotton varieties in terms of yield, land rent, fertilizers and pesticides consumption and miscellaneous expenditure. Comparing the average cost of each input in two varieties, the cost of Bt cotton variety is comparatively less than the non Bt cotton variety. Finally it may be concluded that the farmers can be advised to grow the Bt cotton variety in Kurnool district with respect to input – output structure of two cotton varieties at mean levels.

Analysis of Estimated Regression Coefficients

The collected data on two selected cotton varieties, namely Bt and non Bt in Kurnool district was fed to the regression models viz., linear and log linear. To estimate regression coefficients in both the models the principle of least squares was adopted and the estimated regression coefficients of each variety of cotton are shown in the following table.

Table 3: Estimated Regression Coefficients of Two Cotton Varieties

Variables	Bt Variety		Non Bt Variety	
	Linear	Non - Linear	Linear	Non – Linear
Intercept	16238.551	-1.807	21954.125	-5.920
X₁ – Land Rent	1.7566 (1.9902)	0.3675 (1.9620)	-0.3095 (0.6349)	-0.0534 (0.5169)
X₂ – Labour	0.4460 (0.1706)	0.0629 (0.1892)	3.2900* (2.1710)	0.4476* (2.95)
X₃ – Manure	36.7955* (3.2046)	1.1204* (3.2645)	8.1972* (2.2435)	0.2565* (2.0924)
X₄ – Fertilizers & Pesticides	1.5655 (0.8681)	0.2968 (0.8892)	4.7040* (4.8108)	1.2647* (4.5739)
X₅ – Miscellaneous Expenses	-1.1523 (0.4801)	-0.2006 (0.5854)	0.0501 (0.0289)	0.0060 (0.0244)
R²	0.6816	0.6735	0.7440	0.73158
F	8.1338*	7.8392*	11.0420*	10.3516*
D – Statistic	0.8413	0.8130	1.4811	1.5350
Sum of Coefficients	----	1.647	---	1.9208

Note: Figures in the parentheses indicate 't' - values.

* Significant at 5% probability level.

Bt Cotton Variety

The estimated regression coefficients of the variables (inputs), along with their t – values of Bt cotton variety related to the log linear model was analyzed.

The estimated regression coefficient of land rent is positive but not significant and it is 0.3675. For every one unit increased in land rent will increase the yield of Bt variety by 0.3675 units. From t-Test statistic this increase is an insignificant increase. The coefficient of labour is positive (0.0629) but not significant. It explains that a unit increase in labour will increase the Bt cotton yield by 0.0629 units. This increase is not considerable increase. The coefficient of manure is positive and significant at 5% probability level. For every one unit increase in manure will raise the cotton yield by 1.1204 units. The effect of fertilizers and pesticides on cotton yield is positive. The coefficient of this variable is 0.2969. The effect of fertilizers on cotton yield is not significant. Every one rupee increase in fertilizers and pesticide cost will raise the cotton yield by 0.3 units approximately. It is noticed that the increase is not a significant increase. It is observed that the effect of miscellaneous expenses on the cotton yield is negative and not significant. Every one rupee increased on miscellaneous expenditure will decrease the cotton yield by rupees 0.2. But this decrease is not a significant decrease.

The sum of estimated regression coefficient is 1.647. It shows that the Bt cotton cultivation is operating under increasing returns to scale in Kurnool district. The constant intercept value is negative(-1.807). It is observed that the value of R² is 0.6735. It is known as multiple correlation coefficient. The value of R² explains the combined effect of all independent variables on the dependent variable i.e. the collective effect of inputs on output. From the value of multiple correlation coefficient, it is observed that the selected inputs collectively explained 67.35% of variation in Bt cotton yield. To test the significance of these variables' combined effect on cotton yield, F-Test statistic was carried out. From F- value, it is noted that the combined effect of independent variables on cotton yield is significant at 5% probability level.

Non Bt Cotton Variety:

The estimated multiple correlation coefficients (R^2) is 0.7315. It reveals that the aggregate effect of all exogenous variables on endogenous variable. All these independent variables in the model explain 73.15 percent of variation in non Bt cotton variety in Kurnool district. The significance of R^2 was tested by F-test statistic. It is observed that the combined effect of all inputs is significant on the yield of non Bt cotton variety. The sum of estimated coefficients is 1.9208. It is greater than one (>1) hence non Bt cotton cultivation is also operating under increasing returns to scale. Therefore the cotton cultivation is profitable to its growers in Kurnool district. The value of constant/intercept terms is negative i.e. -5.92.

The estimated regression coefficients of the variables, labour (X_2), manure (X_3), fertilizers and pesticides(X_4) are positive and significant at 5% probability level. There exist a positive relation ship between non Bt cotton yield with each of the above three variables. This positive relation is observed to be a significant relationship. The estimated coefficients of these three variables are 0.4470, 0.2565 and 1.2647 respectively. These values expresses that for every one unit increase in each of variable will increase the cotton yield by 0.447 units, 0.2565 units and 1.2647 units respectively. The coefficient of miscellaneous expenses variable (X_5) is positive but not significant. From the estimated value of X_5 (0.006) it is found that the effect of miscellaneous expenses on cotton yield is almost negligible. The coefficient of land rent is negative (-0.0534). It reveals that there exists a negative relationship between land rent and cotton yield. But this negative relationship is not a significant relationship. Negative relation reveals and increase a land rent will decrease the cotton yield.

Comparing the two variables of cotton, it is noticed that the two cotton crops' cultivation is operating under increasing returns to scale. Hence the cotton cultivation is profitable to growers in Kurnool district. Manures and fertilizers effect on cotton yield is observe to the significant. The selected variables was collectively expressed a significant relation with cotton yield. By the input output structure it is noticed that Bt cotton variety is more profitable than the non Bt varieties in the district. It is also found that the mean values of input cost is comparatively less incase of Bt variety, at the same time the returns are high. Observing the benefit cost ratio, it is more incase of Bt cotton variety. Finally it may be concluded that the both varieties of cotton are profitable and more suitable. Between these two varieties, comparatively Bt variety is better than the Non Bt variety.

Marginal Value of Productivities (MVP)

The marginal value of products (MVP) was calculated for two selected cotton varieties, Bt and Non Bt with the help of formula given in the methodology chapter and these marginal value of products are shown in the table 4.

Table 4: Marginal Value of Productivities of Two Varieties

Varieties	X_1	X_2	X_3	X_4	X_5
Bt	0.4331	0.0790	1.7174	0.3560	-0.2490
Non Bt	-0.0632	0.5555	0.3860	1.4538	0.0074

From the table 4, it is observed that the marginal value of products of the variable cost of manure was recorded as maximum in case of Bt cotton variety. The minimum MVP value was recorded in case of the variable cost of labour. A negative MVP value (-0.2490) was noticed for the variable miscellaneous expenses. It means an increase in one unit of miscellaneous variable will decrease the Bt variety cotton yield. In case of remaining two variables, land rent and fertilizers and pesticides, the MVP values are 0.4331 and 0.3560 respectively.

In case of Non Bt cotton variety, a negative marginal value of productivity was observed in case of the variable land rent. It reveals a unit increase will decrease the Non Bt variety of cotton yield. The maximum MVP value (1.4538) was recorded in case of the variable fertilizers and pesticides whereas the minimum MVP value (0.0074) was in case of miscellaneous expenditure. The MVP values of remaining two variables, cost of labour and cost of manure, are 0.5555 and 0.3860 respectively. It explains for every one unit increase in each of these variables will increase the Non Bt cotton variety yield by 0.55 units and 0.38 units respectively.

Comparing the MVP values of the two varieties of cotton, miscellaneous expenditure in case of Bt variety and land rent in case of Non Bt variety reveals an inverse relationship with the cotton yield. Similarly, the land rent and miscellaneous expenditure variables in case of Bt and Non Bt varieties establish a positive relationship. The higher stability value was observed in case of Bt variety with respect to variable cost of manure. And it is the highest in case of Non Bt variety with respect to variable fertilizers and pesticides. Hence, it is inferred that the cotton cultivators in Kurnool District may raise the cotton yield by increasing manure in case of Bt variety and pesticides in case of Non Bt variety. Since these MVP values are greater than 1, hence it is inferred that there is some scope to raise the cotton productivity in Kurnool District by raising these two variables.

CONCLUSIONS

Indian agriculture has come out of its traditionality after the Green Revolution. It is needless to say that the Indian agriculturists earning their income more through cultivating cash crops. A significant relationship in the use of inputs for variety of cash crops. A small study is identified for input output relations in cotton cultivation. Kurnool District was purposefully selected to study some aspects of cotton cultivation. Since Kurnool District is a major cotton producing district in Rayalaseema region of Andhra Pradesh. Among the different aspects of cotton cultivation, resource use efficiency is one aspect. The major findings of this chapter are given below.

From the observations of cost and return structure of two varieties of cotton in Kurnool District, it is noticed that the gross returns are more in Bt variety than in case of Non Bt cotton variety. Similarly in case of net returns, benefit cost ratio Bt cotton variety possessing better values than Non Bt variety. With respect to gross cost, Non Bt variety stands first. Hence, it is inferred that the Bt cotton variety is more beneficial than Non Bt variety. Therefore, Bt cotton variety is an advisable variety to grow in Kurnool District. The farm business analysis expresses that the Bt variety has the highest profitability from the growers' point of view.

Observing the input output structure of cotton varieties, a significant difference between yields of two cotton varieties was recorded. It is noticed that average expenditure of each input factor in Bt variety is less than the corresponding variable in Non Bt variety. A significant difference was recorded at mean level of inputs, viz. land rent, fertilizers and pesticides and miscellaneous expenditure. There is no significant difference in mean values of labour and manure between the two varieties. The net returns are also more in Bt variety. One can conclude from the above observations that Bt variety is more profitable than Non Bt variety.

The factor product relation was established for the two selected cotton varieties in Kurnool District. From the analysis of estimated coefficients of two varieties, it is observed that the two cotton varieties cultivation is operating under increase returns to scale, since the some of the estimated coefficients (log linear model) is greater than 1. The collective effect of the variables on their respective cotton yields is significant. In both the varieties of cotton, it is recorded that the

two variables manure, fertilizers and pesticides individually establish a significant positive relationship with the cotton yield. It is also noticed that the cotton yield may be increased by raising these two variables.

From the analysis of marginal value of productivities, the MVP value of manure is more in Bt cotton variety and the MVP value of fertilizers and pesticides variable is more in case of Non Bt variety. From MVP values (1.7174), (1.4538) of two variables X_3 and X_4 in two varieties Bt and Non Bt, the cotton yields may be increased in increasing returns by increasing these two variables, because MVP is greater than 1. Hence, there is some possibility to raise the cotton yields by increasing these two variables in two respective cotton varieties. The MVP value of miscellaneous expenditure in Bt variety, land rent in Non Bt variety are negative. The negative value of MVP reveals a decrease in cotton yield. Comparing the MVP values of two varieties, it is concluded that Bt cotton variety is more profitable to its growers than the Non Bt cotton variety.

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